Update: Marine Dissolved Oxygen Monitoring in Mount Hope Bay

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MassDEP
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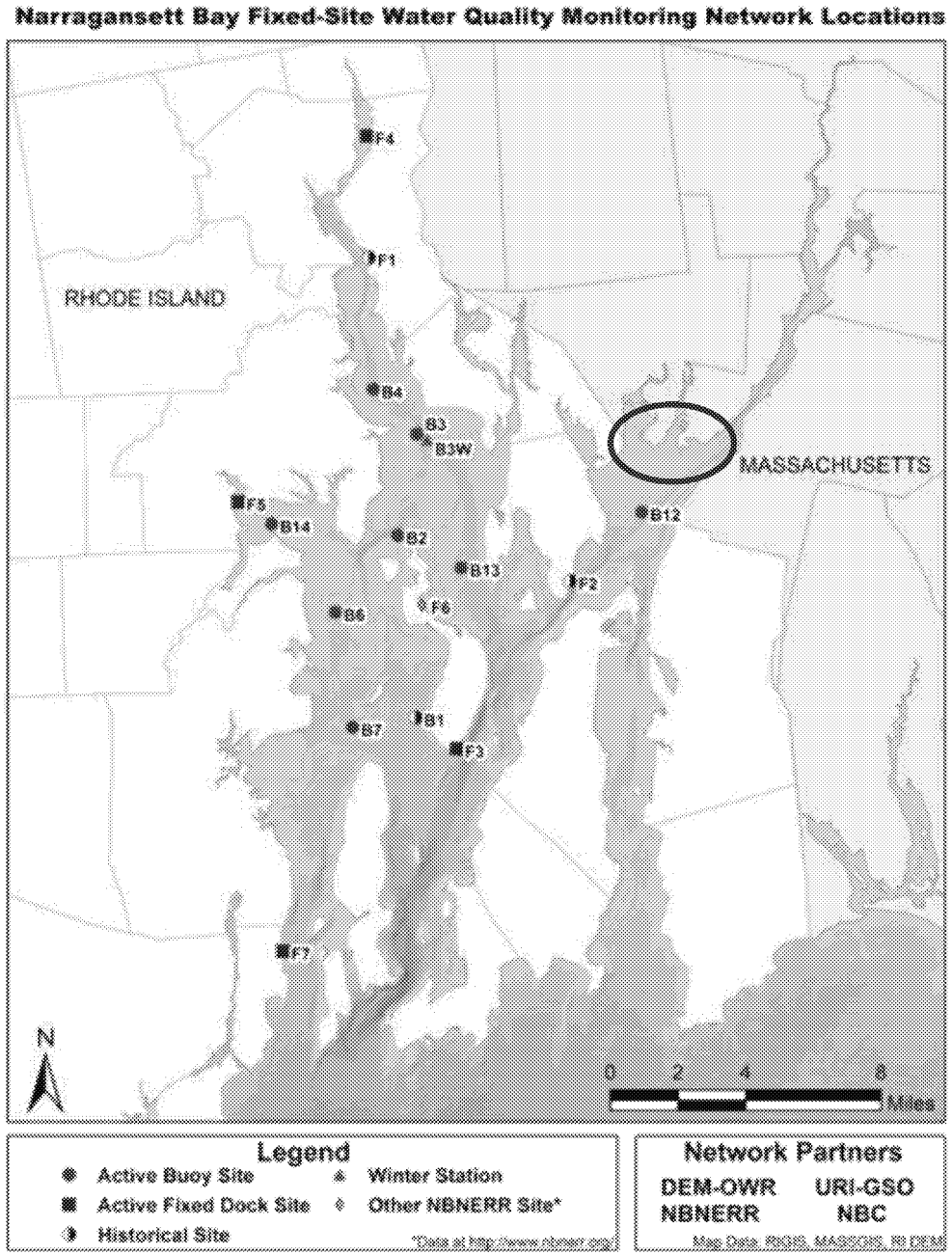
Department of Environmental Protection

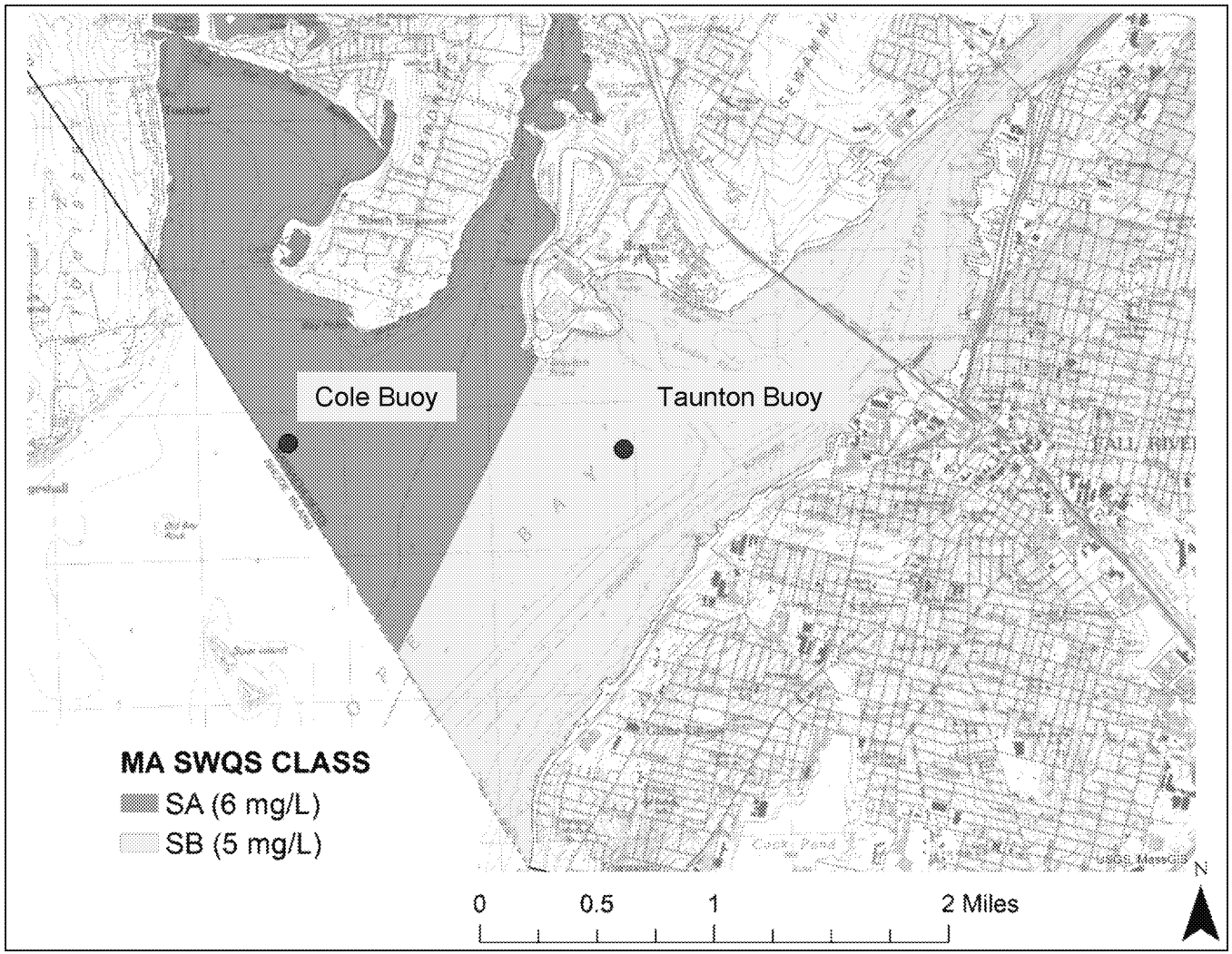


Mount Hope Bay Water Quality Data

- No NBFSMN stations were previously located in the eastern portion of Mount Hope Bay and the Taunton River, MA
- 2016: two MassDEP water quality monitoring buoys expand URI and RIDEM's NBFSMN
- MassDEP buoys were deployed again in 2017 and will be deployed in 2018
- The buoys address data gaps in the MA waters of Narragansett Bay and its sub-embayment Mount Hope Bay

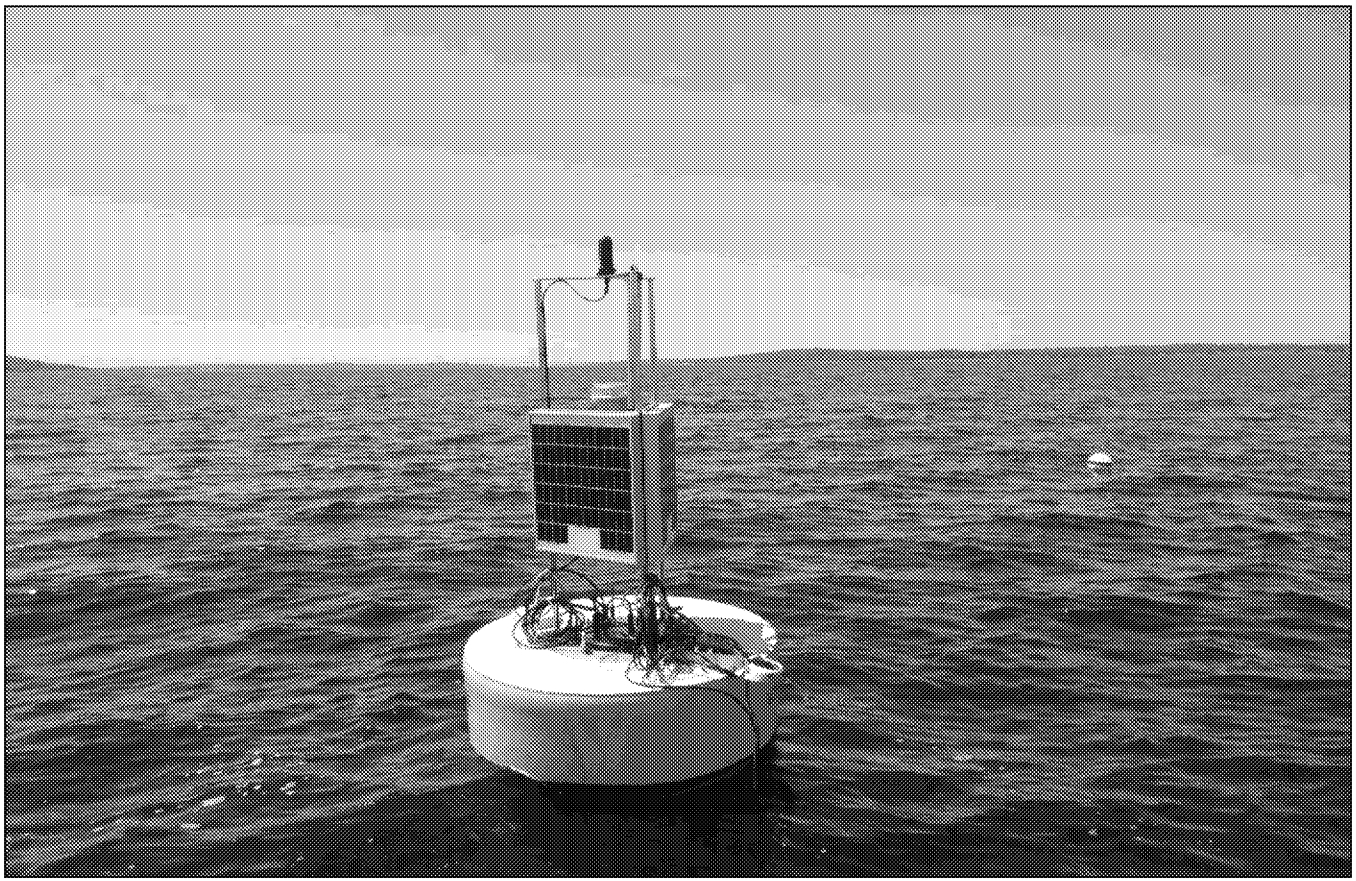
MassDEP Buoy Monitoring Locations

- **MA Surface Water Quality Standards (SWQS)**
- Two class designations for MHB: SA and SB

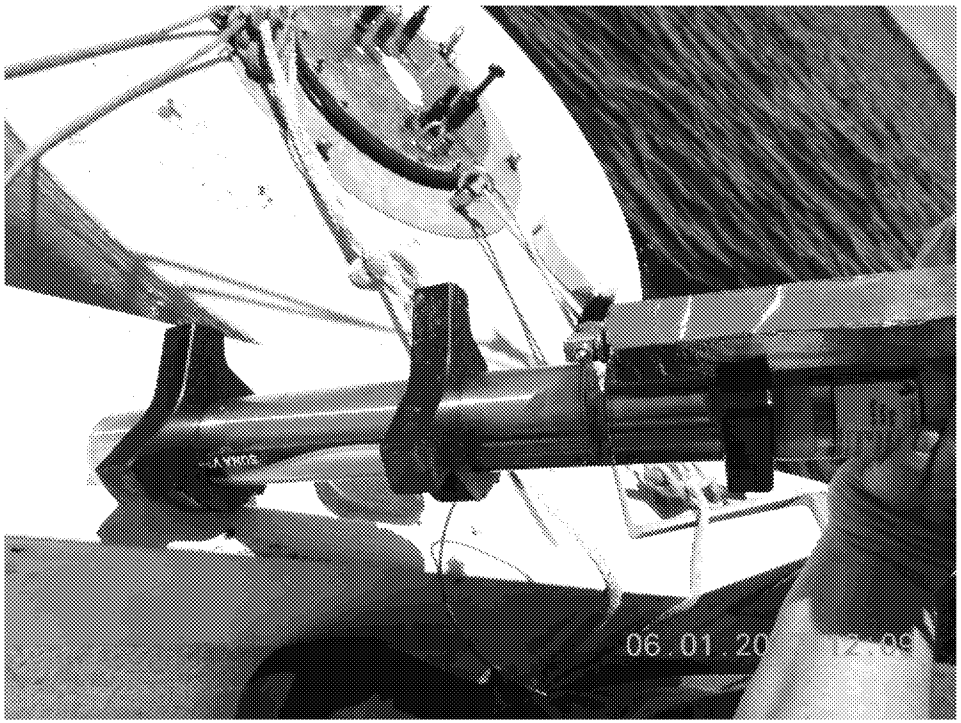


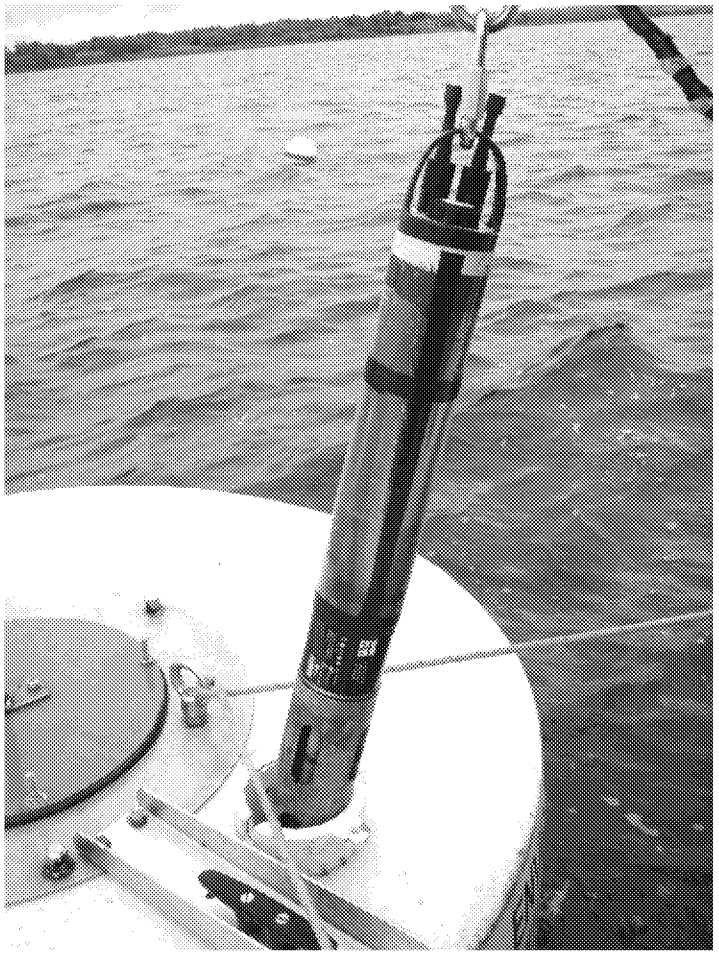
Mount Hope Bay Buoy Deployment

- **Additional measurements:** Nitrate-nitrogen, temperature, pH, specific conductivity, salinity, chlorophyll, and blue-green algae



Two Types of Measurement Sensors

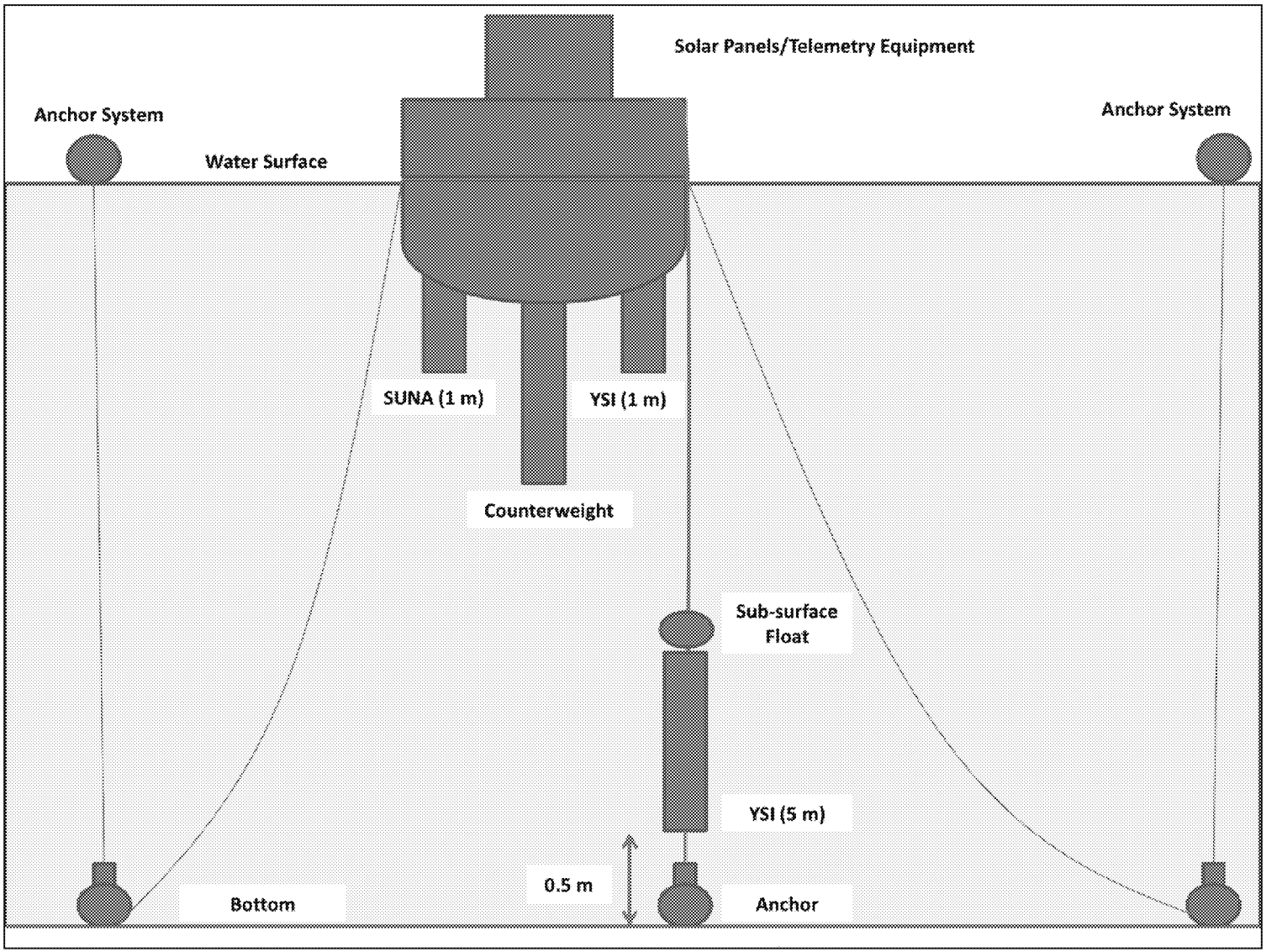




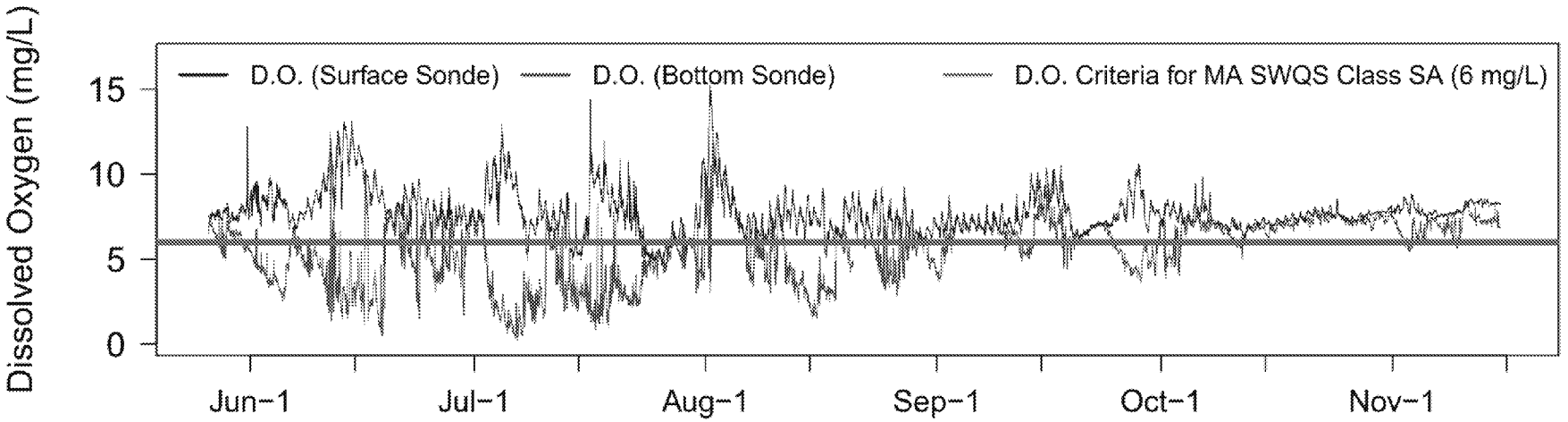
- Submersible Ultraviolet Nitrate Analyzer (SUNA)
- Measures nitrate-nitrogen concentrations only
- Hourly measurements at 1m depth

- YSI EXO2: multi-parameter sonde
- Measures all other parameters
- Every 15 minutes at two depths (1m and 5m)

Mount Hope Bay Buoy Deployment

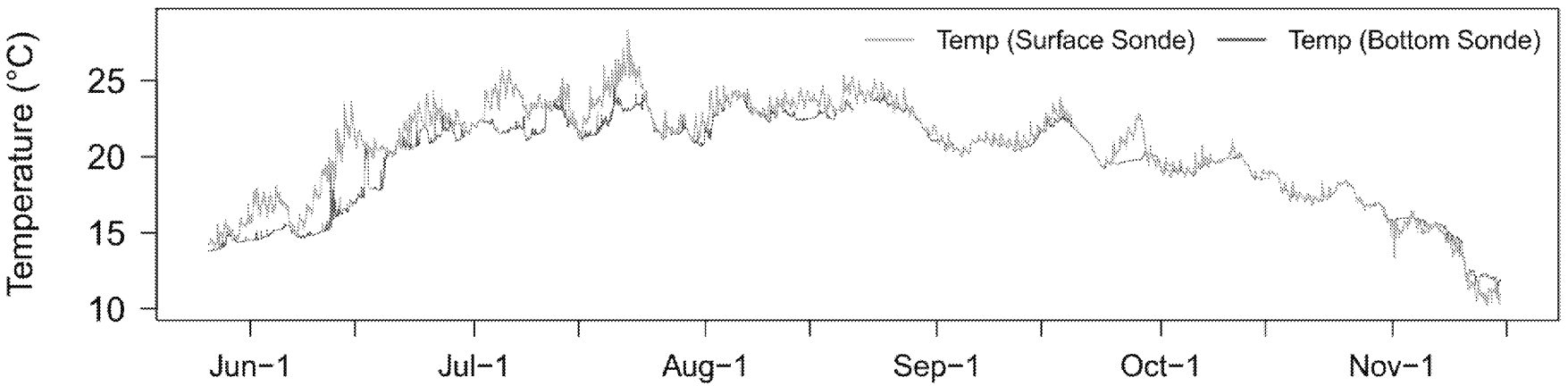


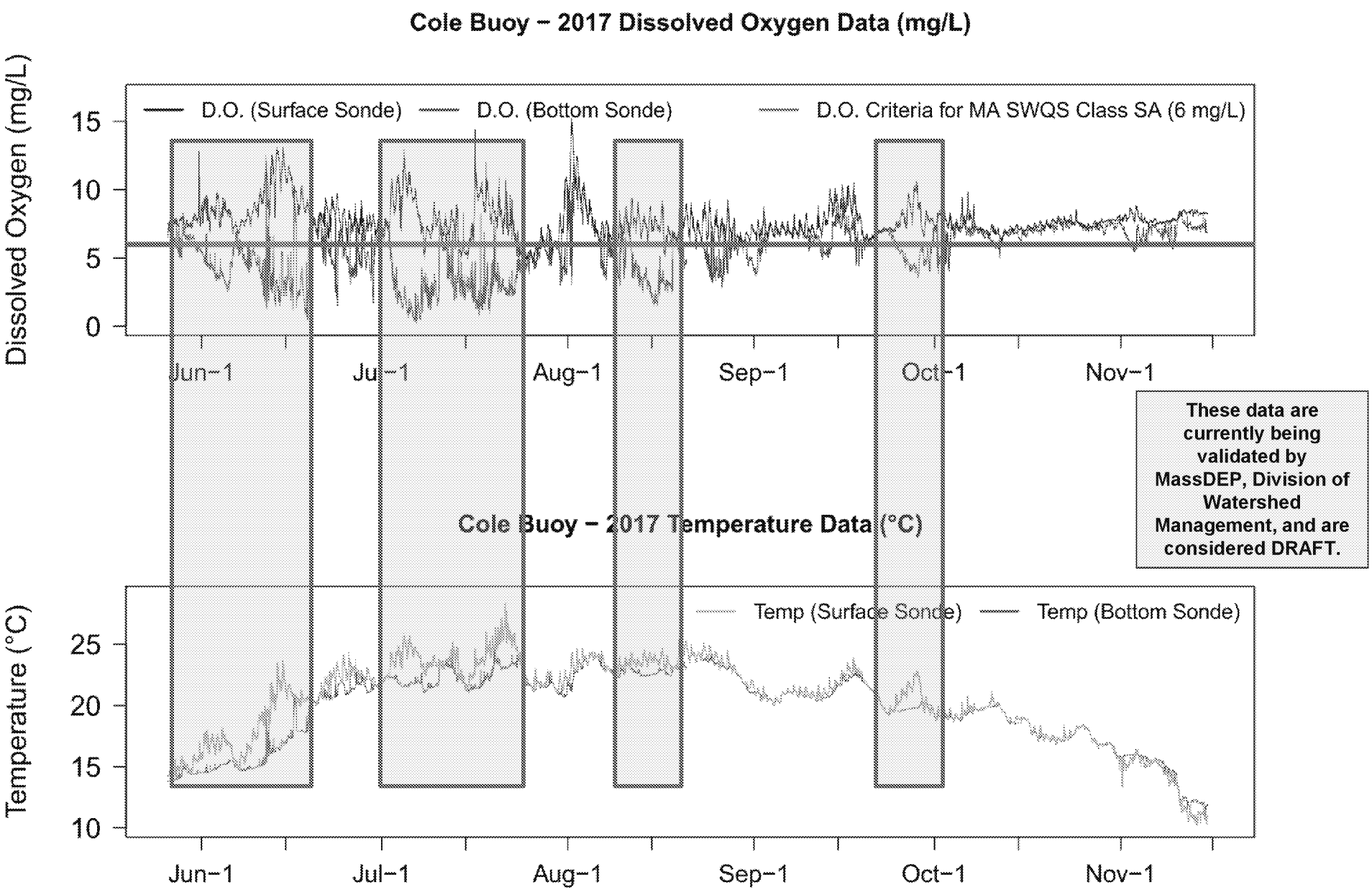
Cole Buoy – 2017 Dissolved Oxygen Data (mg/L)



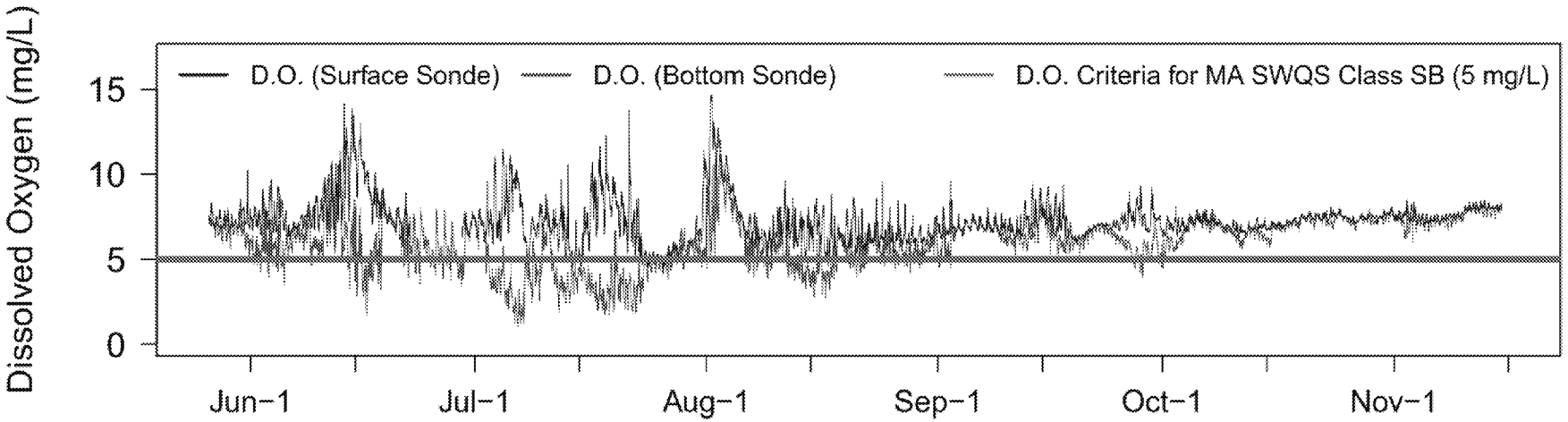
These data are currently being validated by MassDEP, Division of Watershed Management, and are considered DRAFT.

Cole Buoy – 2017 Temperature Data (°C)




Cole Buoy – 2017 Dissolved Oxygen Data (mg/L)
Dissolved Oxygen (mg/L)
D.O. (Surface Sonde)
D.O. (Bottom Sonde)
D.O. Criteria for MA SWQS Class SA (6 mg/L)
15
10
5
0
Jun–1
Jul–1
Aug–1
Sep–1
Oct–1
Nov–1
These data are currently being validated by MassDEP, Division of Watershed Management, and are considered DRAFT.
Cole Buoy – 2017 Temperature Data (°C)
Temperature (°C)
Temp (Surface Sonde)
Temp (Bottom Sonde)
25
20
15
10
Jun–1
Jul–1
Aug–1
Sep–1
Oct–1
Nov–1

Taunton Buoy – 2017 Dissolved Oxygen Data (mg/L)



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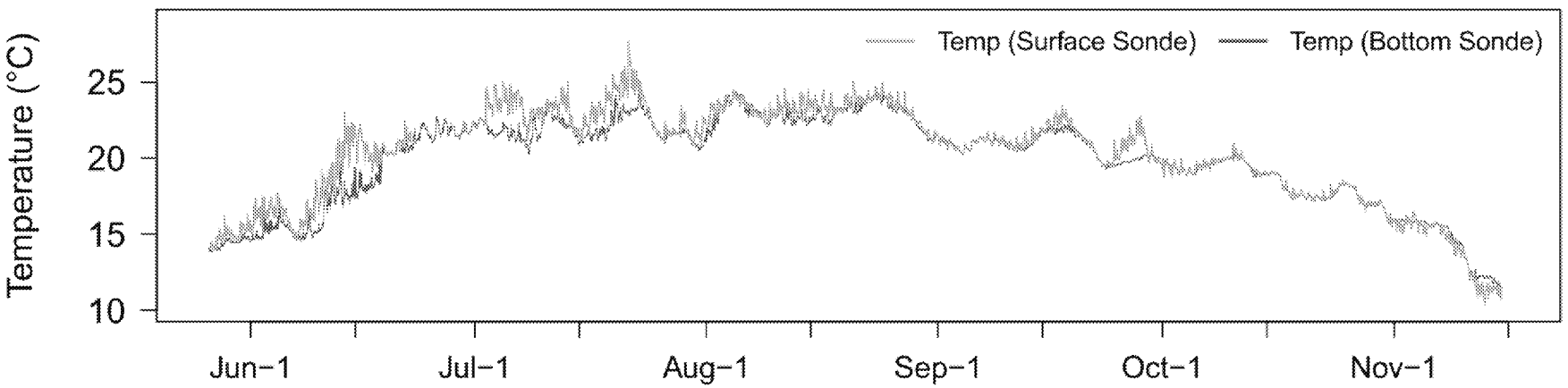
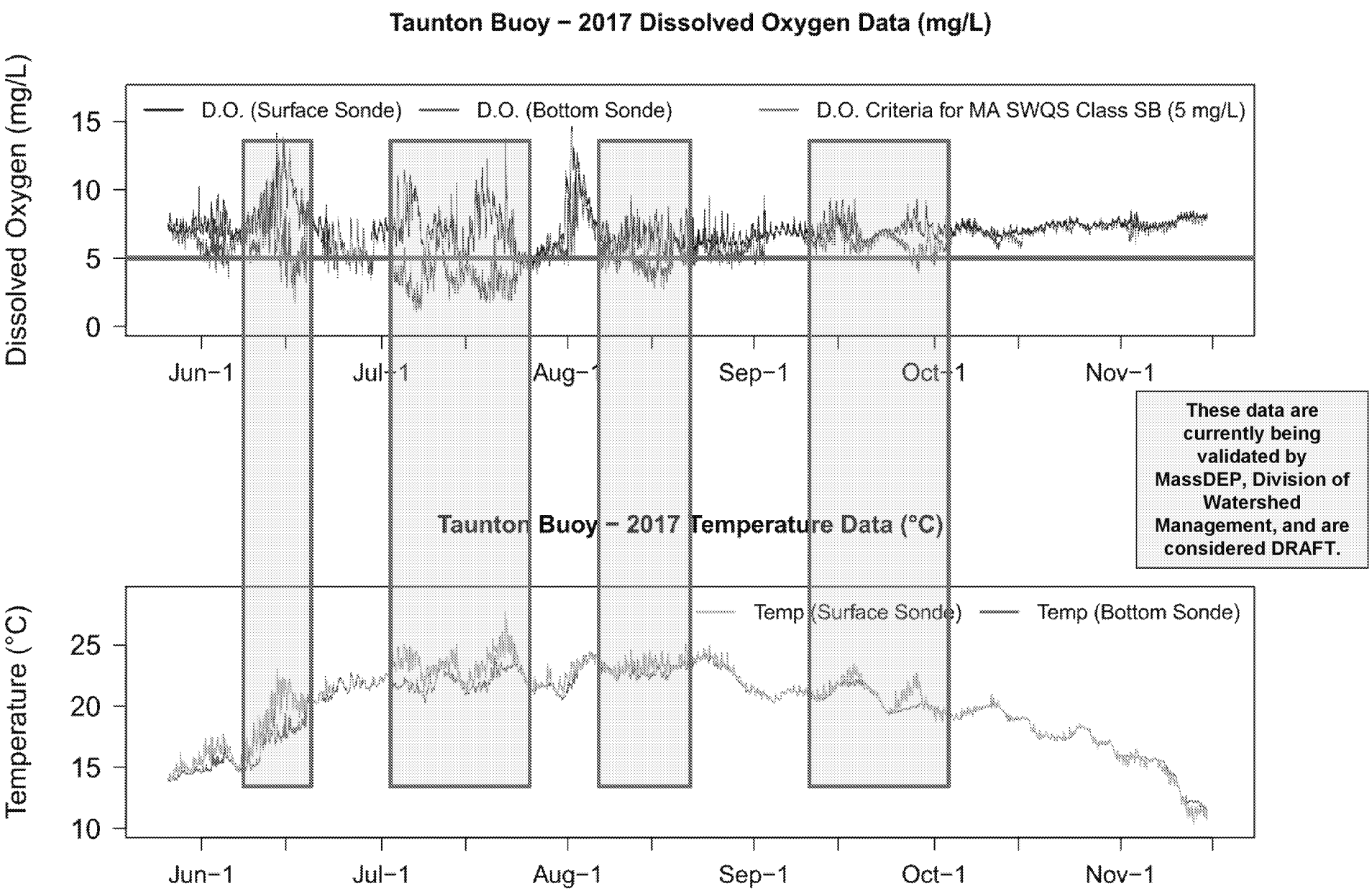
Taunton Buoy – 2017 Temperature Data (°C)




Taunton Buoy – 2017 Dissolved Oxygen Data (mg/L)
Dissolved Oxygen (mg/L)
D.O. (Surface Sonde)
D.O. (Bottom Sonde)
D.O. Criteria for MA SWQS Class SB (5 mg/L)
15
10
5
0
Jun–1
Jul–1
Aug–1
Sep–1
Oct–1
Nov–1
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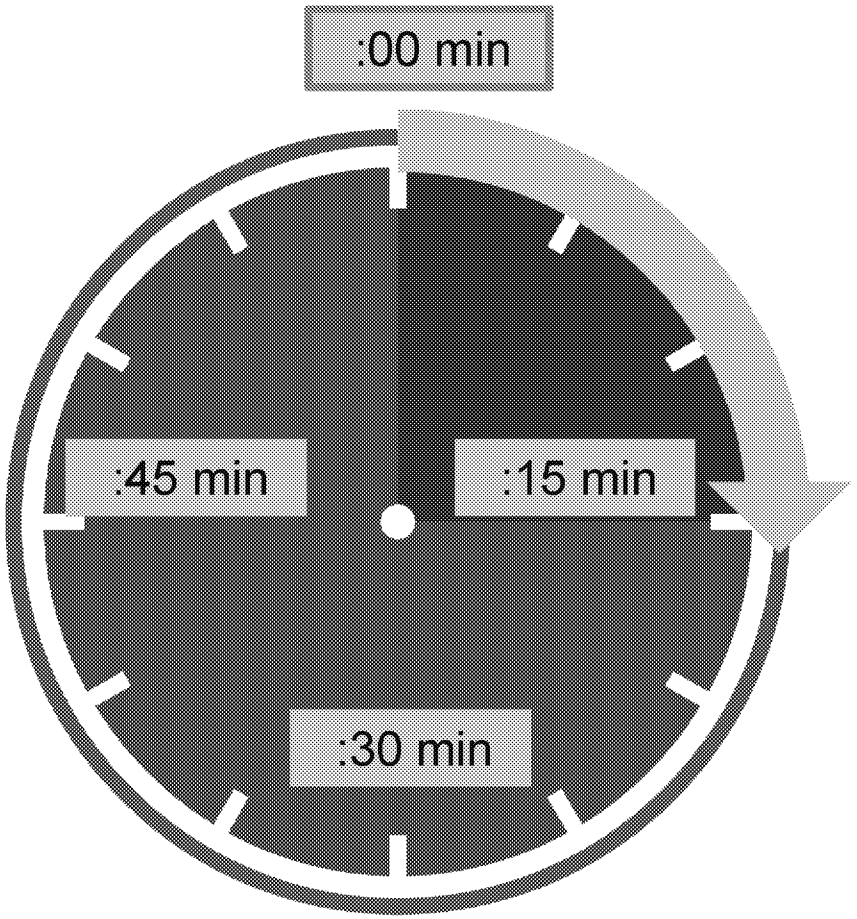
Taunton Buoy – 2017 Temperature Data (°C)
Temperature (°C)
Temp (Surface Sonde)
Temp (Bottom Sonde)
25
20
15
10
Jun–1
Jul–1
Aug–1
Sep–1
Oct–1
Nov–1

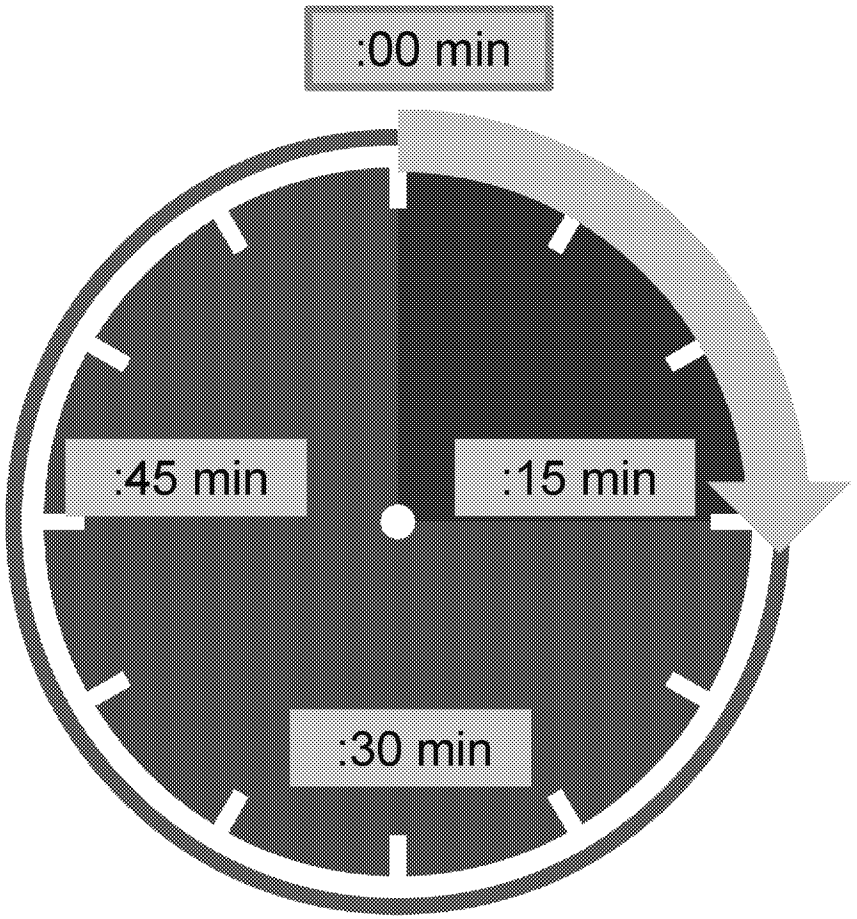
Buoy D.O. Concentrations:
Calculating Hourly Durations Below Thresholds



Source: learn.cli.org

- Buoys measure D.O. concentrations every 15 minutes
- There are four D.O. concentration measurements each hour, but only the first measurement (:00 min) is evaluated
- If the D.O. concentration for the first measurement falls below a threshold, the entire hour is considered to be below the threshold
- The number of hours per day below each D.O. threshold were calculated for each buoy

Buoy D.O. Concentrations:
Calculating Hourly Durations Below Thresholds

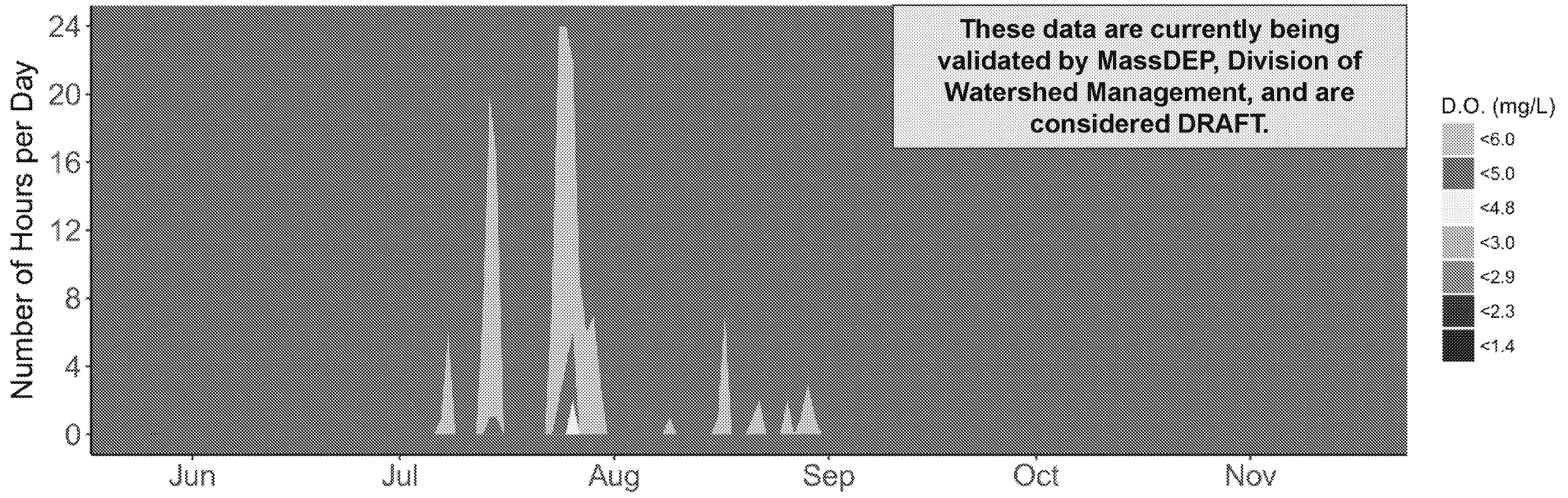


Source: learn.cli.org

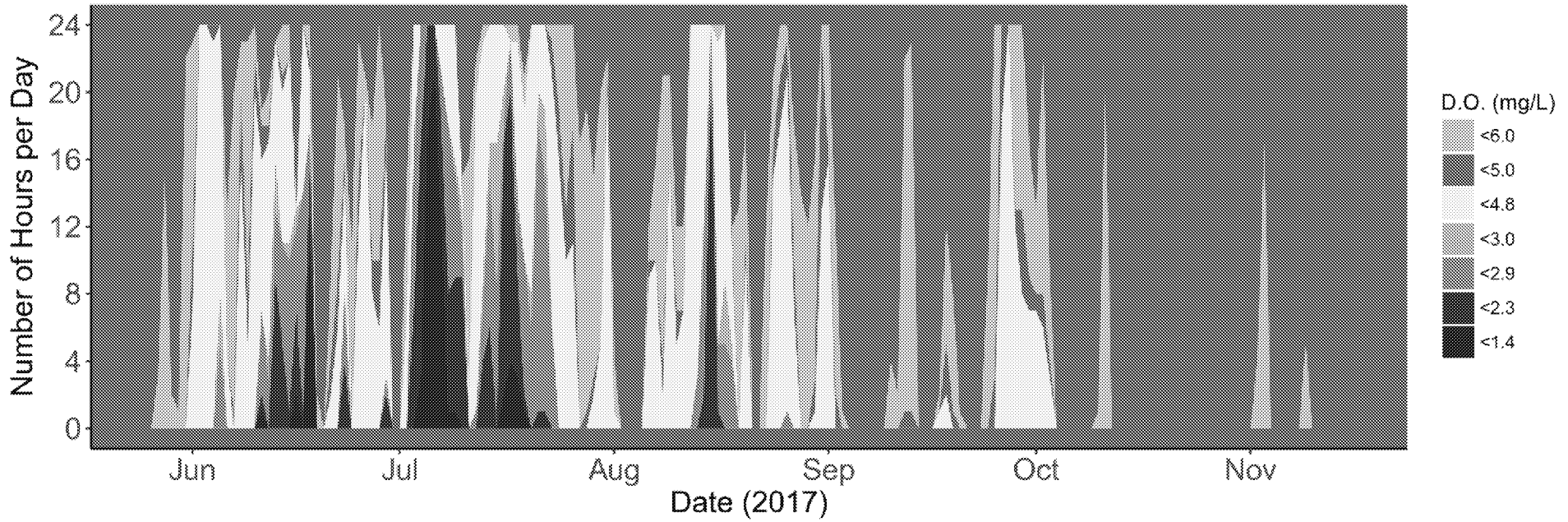
D.O. Concentration Thresholds

- **6.0 mg/L**: MA SWQS criterion for Class SA
- **5.0 mg/L**: MA SWQS criterion for Class SB
- **4.8 mg/L**: EPA (2000) chronic criterion to protect growth effects; Rhode Island adopted this instantaneous value with exceptions
- **3.0 mg/L**: Literature value used to describe hypoxia
- **2.9 mg/L**: RI's threshold (>24 hrs from May 1st – Oct 1st) to protect larval life stage below the pycnocline
- **2.3 mg/L**: EPA (2000) acute criterion to protect adult/juveniles from 24 hr exposure to low D.O.
- **1.4 mg/L**: RI's threshold (>1 hr and more than twice from May 1st – Oct 1st)

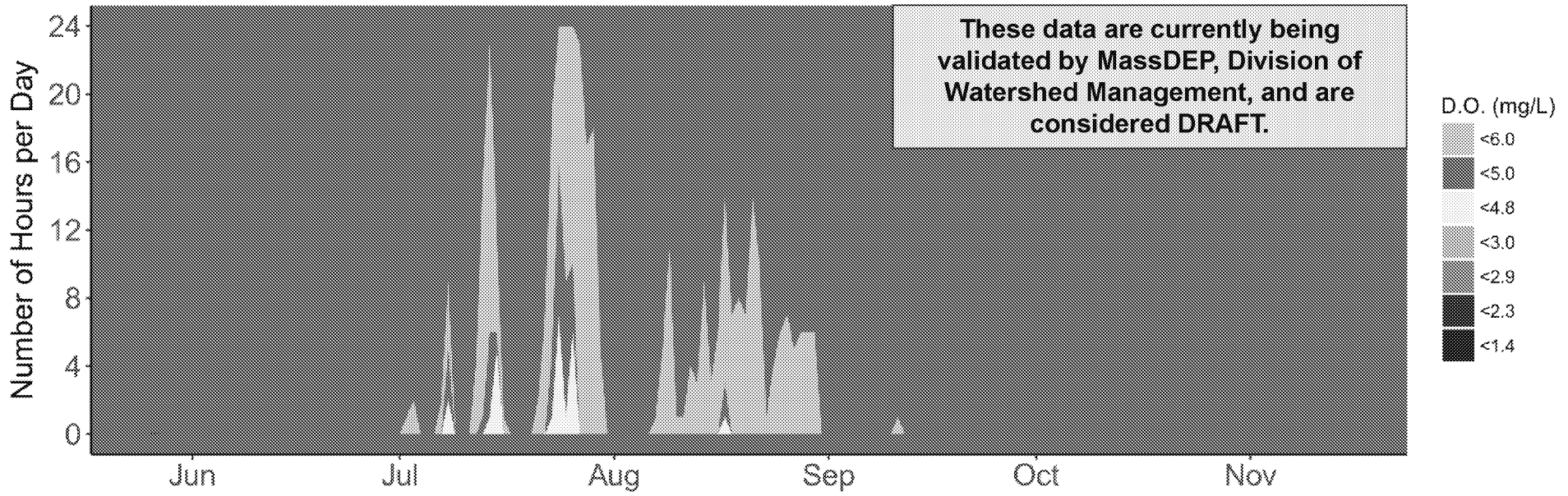
Cole Buoy – Hourly Durations Below D.O. Thresholds (Surface Sonde)



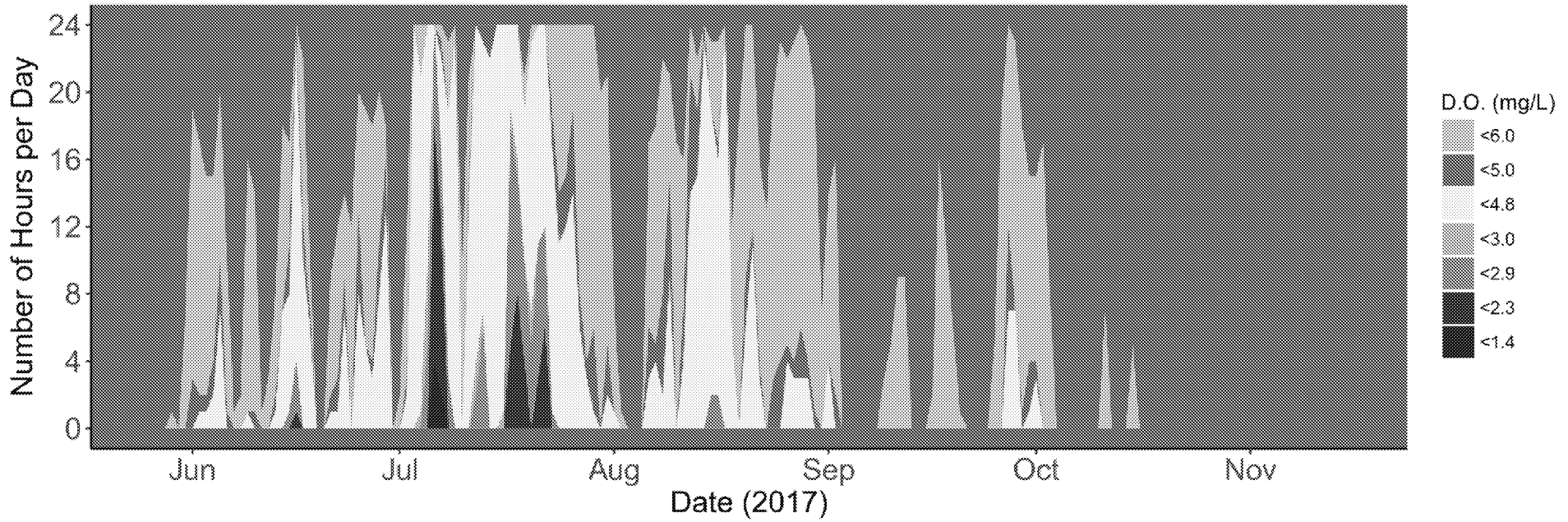
Cole Buoy – Hourly Durations Below D.O. Thresholds (Bottom Sonde)

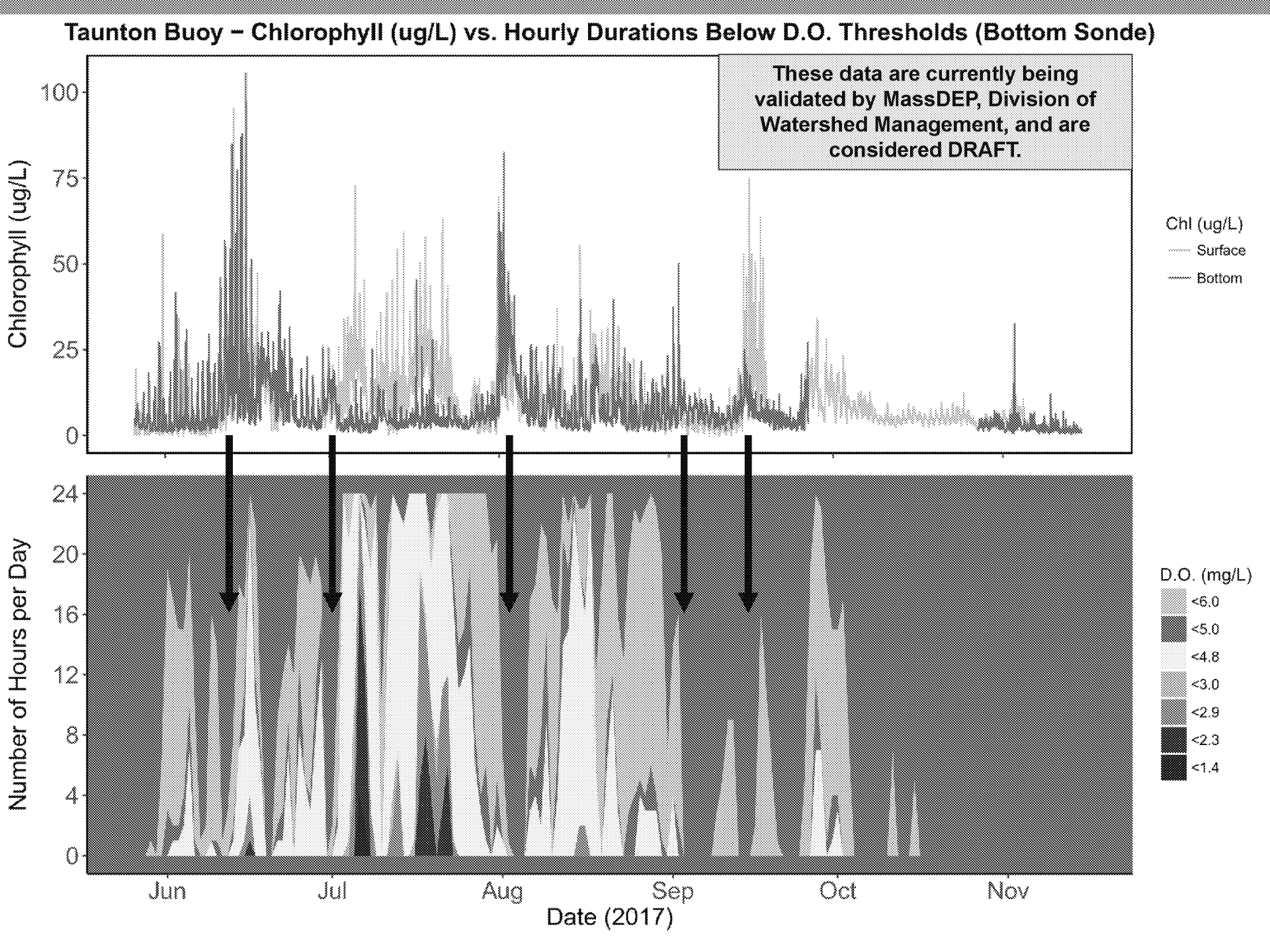


Taunton Buoy – Hourly Durations Below D.O. Thresholds (Surface Sonde)



Taunton Buoy – Hourly Durations Below D.O. Thresholds (Bottom Sonde)





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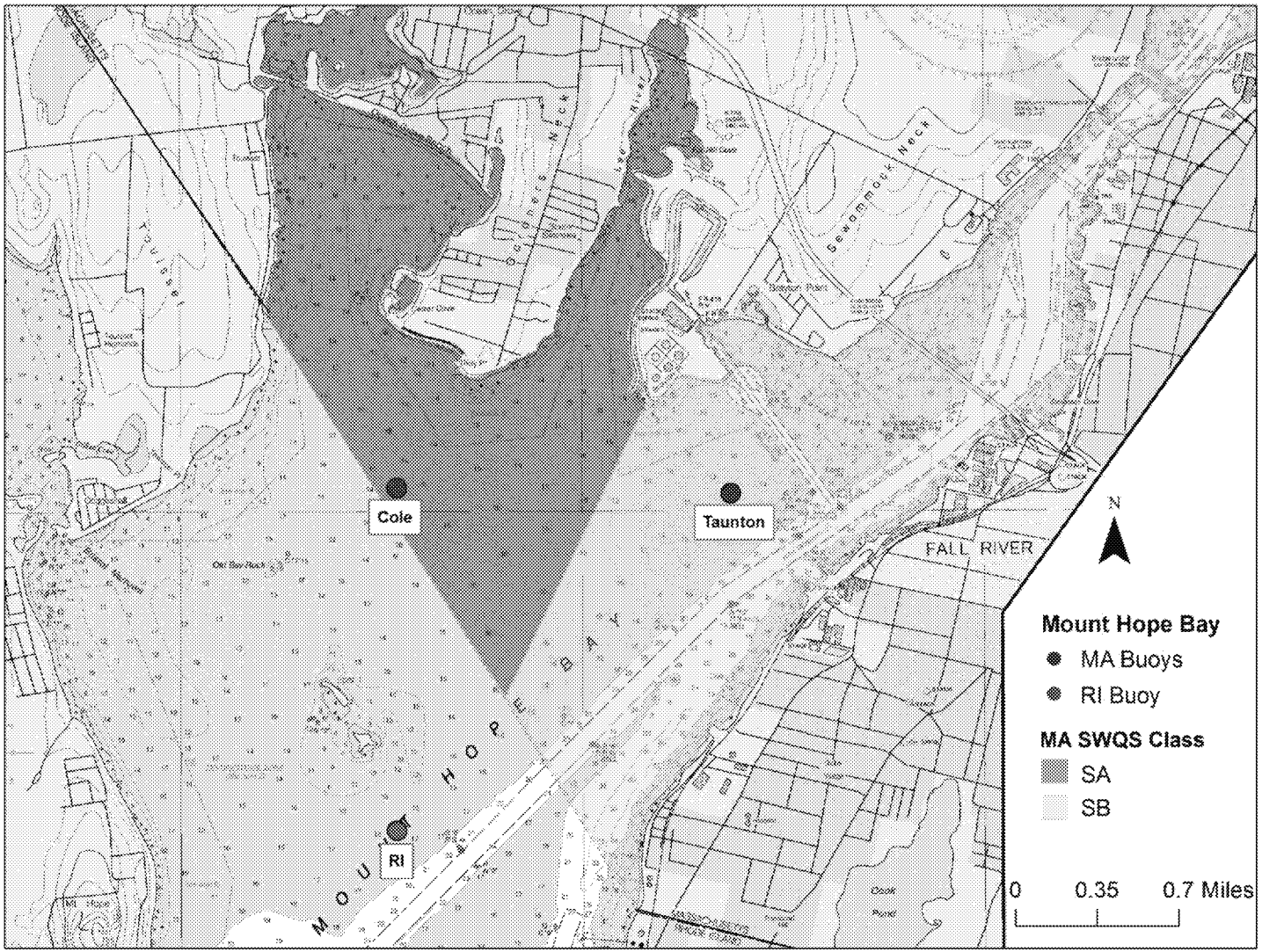
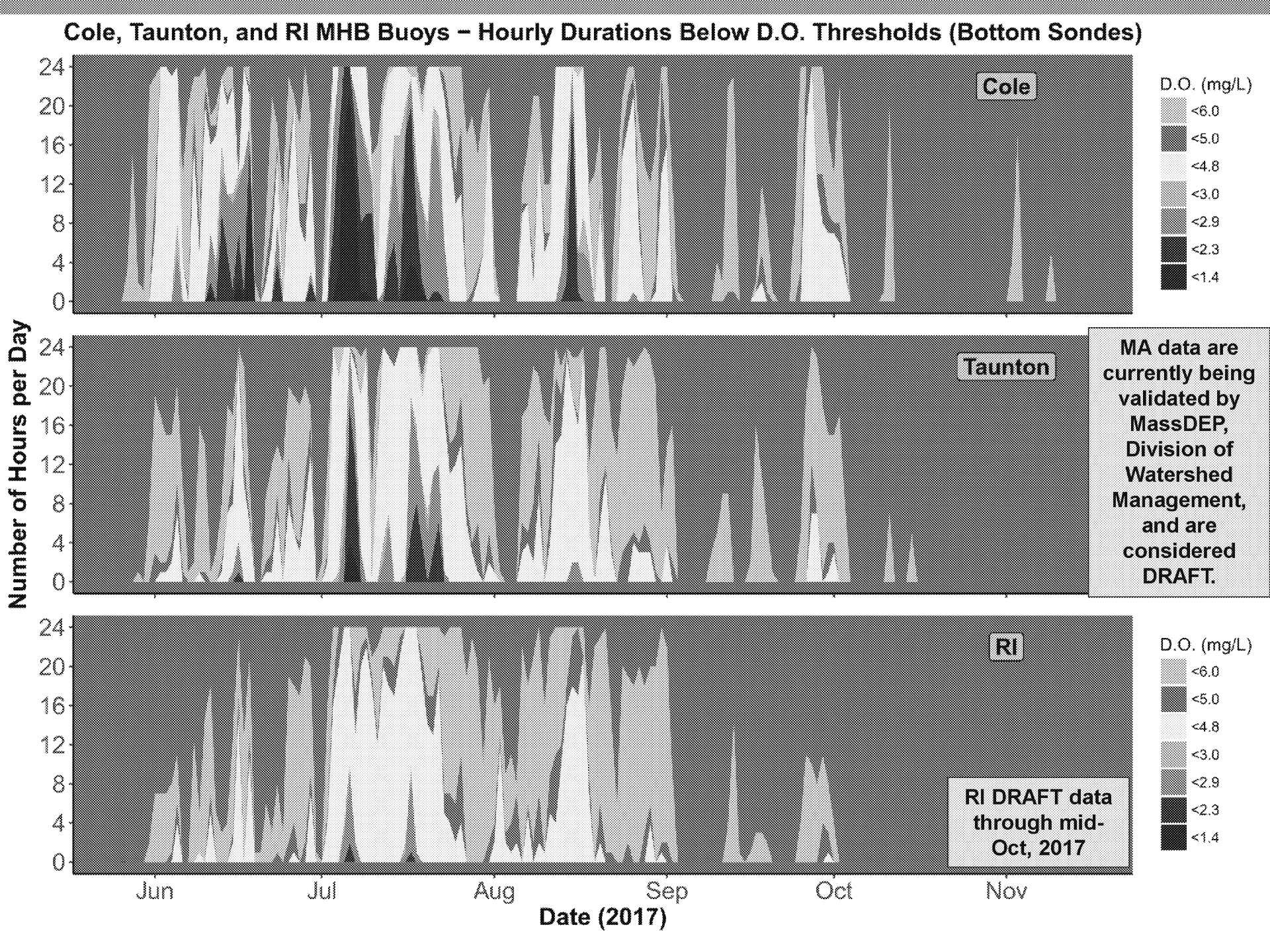
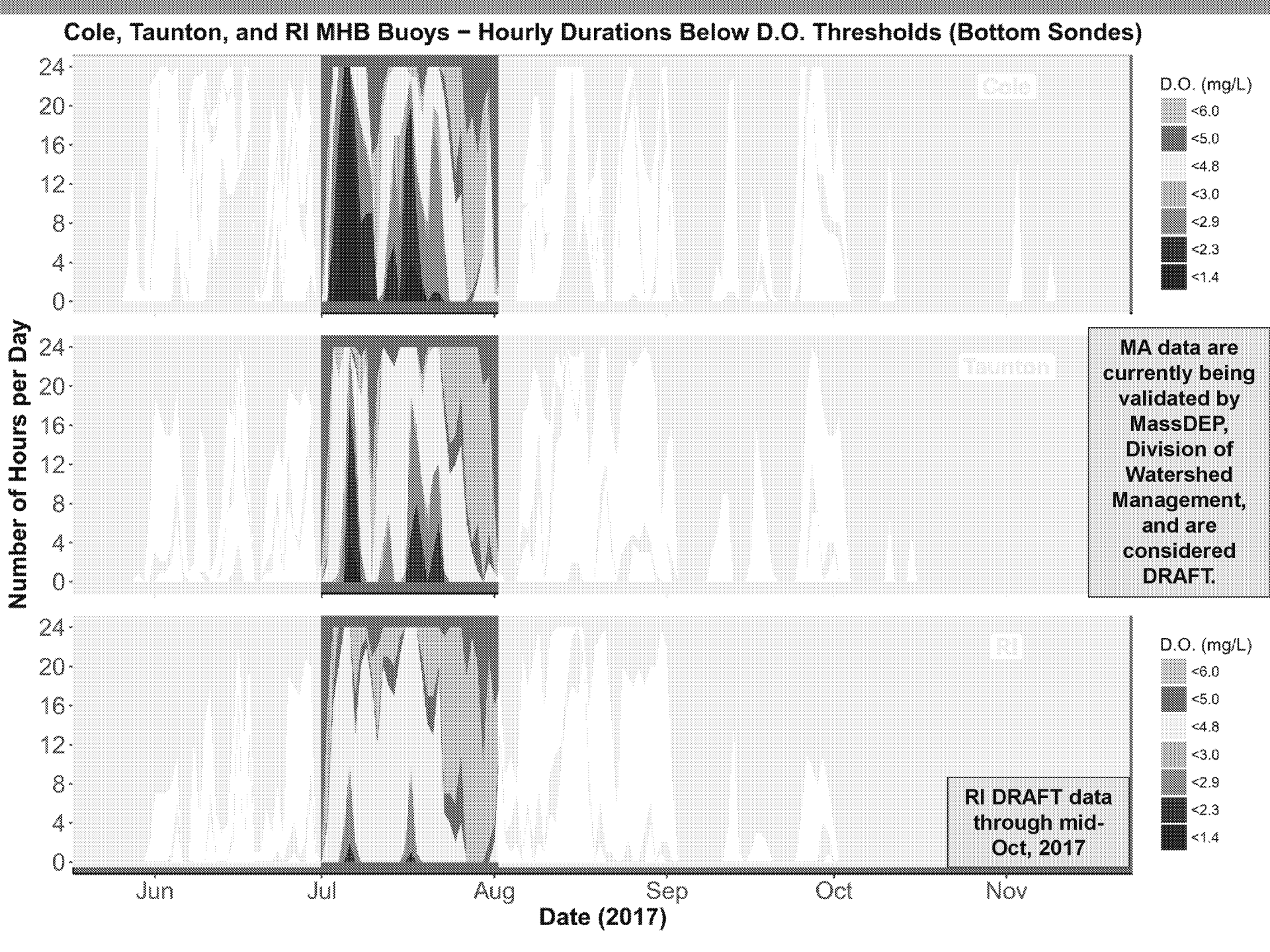
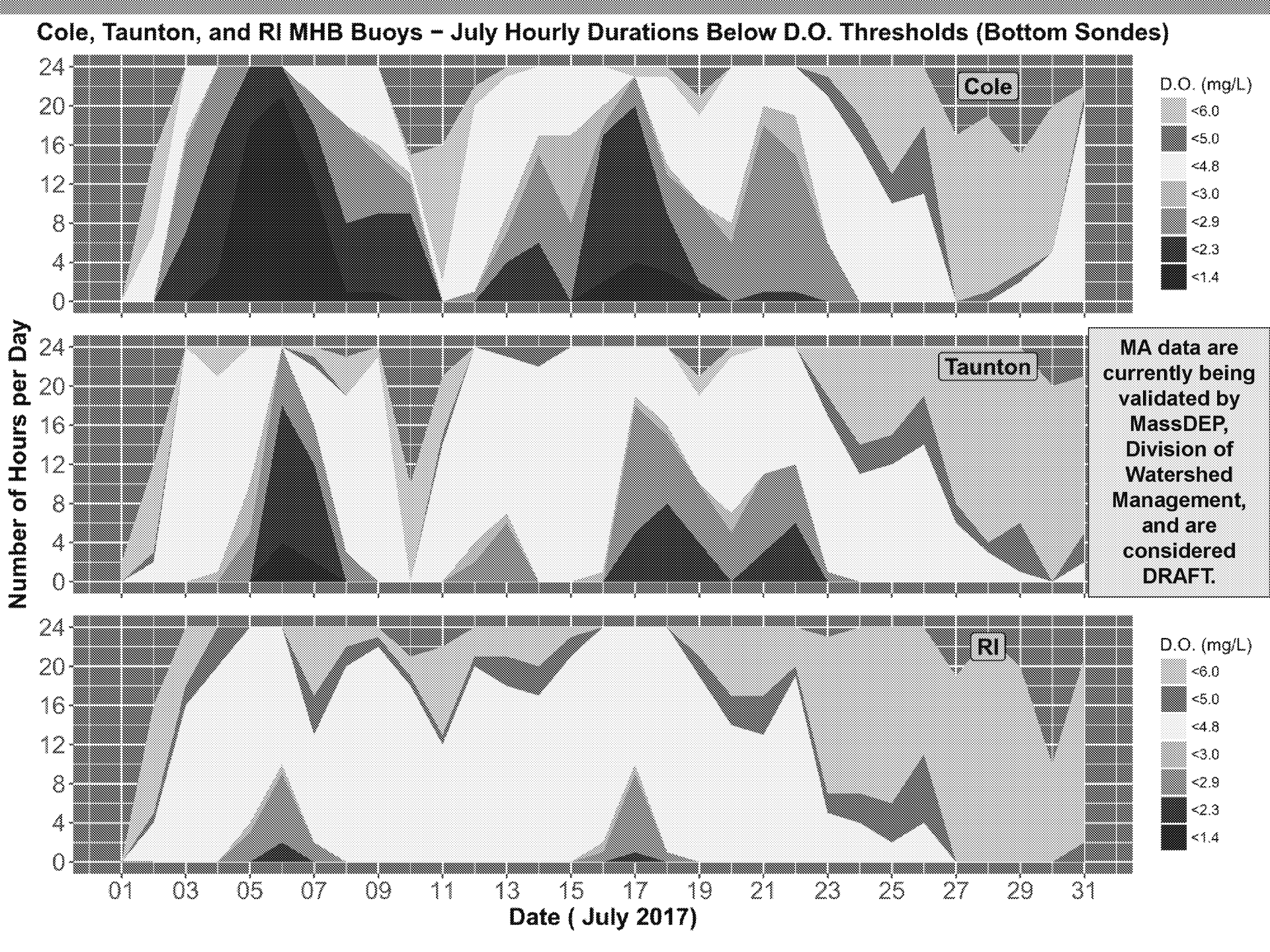
MA and RI MHB Buoy Locations




Cole, Taunton, and RI MHB Buoys – Hourly Durations Below D.O. Thresholds (Bottom Sondes)
Cole
Taunton
RI
D.O. (mg/L)
<6.0
<5.0
<4.8
<3.0
<2.9
<2.3
<1.4
Number of Hours per Day
0
4
8
12
16
20
24
Jun
Jul
Aug
Sep
Oct
Nov
Date (2017)
MA data are currently being validated by MassDEP, Division of Watershed Management, and are considered DRAFT.
RI DRAFT data through mid-Oct, 2017

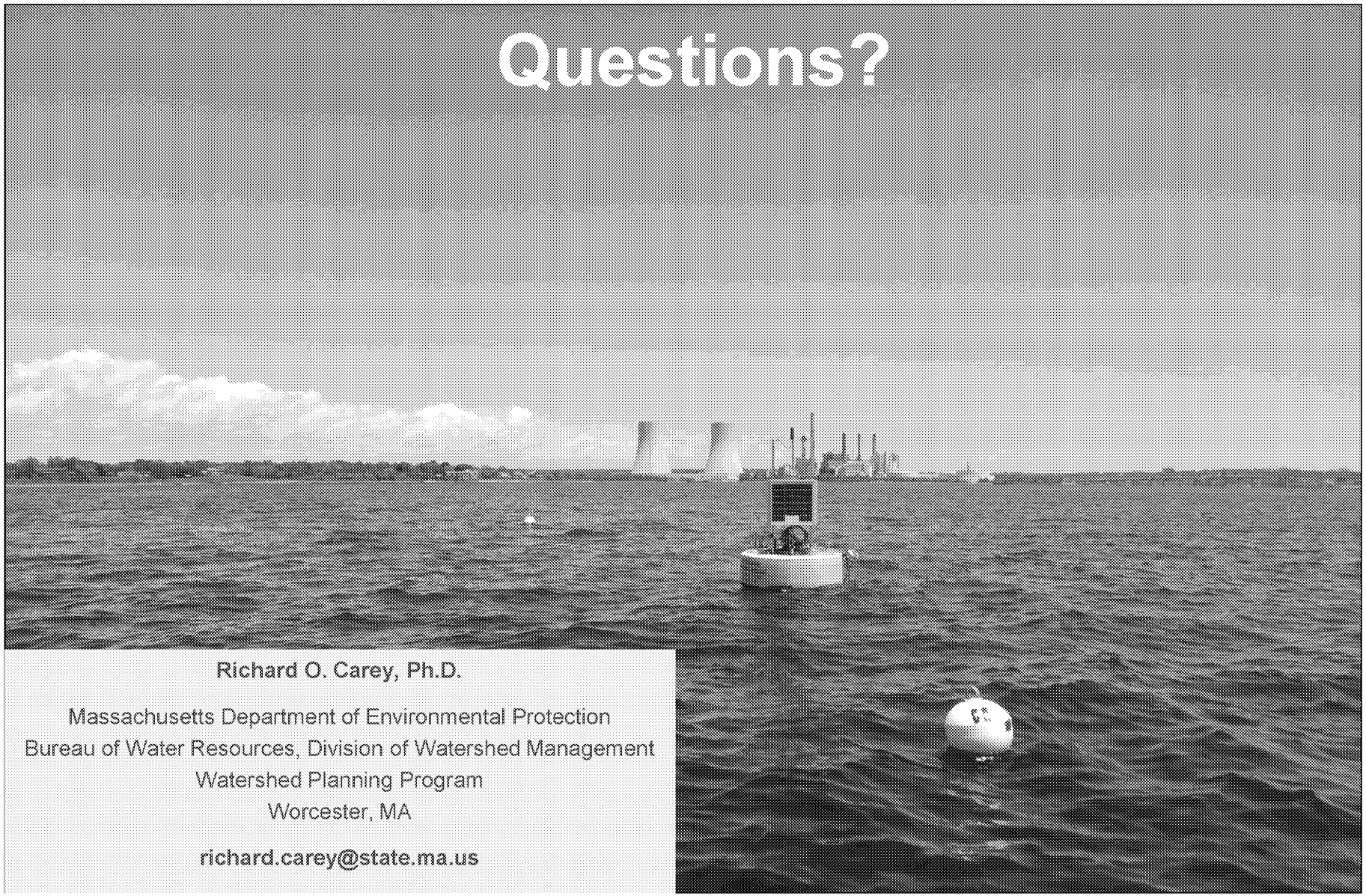

Cole, Taunton, and RI MHB Buoys – Hourly Durations Below D.O. Thresholds (Bottom Sondes)
Number of Hours per Day
24
20
16
12
8
4
0
Cole
Taunton
RI
D.O. (mg/L)
<6.0
<5.0
<4.8
<3.0
<2.9
<2.3
<1.4
MA data are currently being validated by MassDEP, Division of Watershed Management, and are considered DRAFT.
RI DRAFT data through mid-Oct, 2017
Jun
Jul
Aug
Sep
Oct
Nov
Date (2017)


Cole, Taunton, and RI MHB Buoys – July Hourly Durations Below D.O. Thresholds (Bottom Sondes)
Cole
Taunton
RI
D.O. (mg/L)
<6.0
<5.0
<4.8
<3.0
<2.9
<2.3
<1.4
Number of Hours per Day
0
4
8
12
16
20
24
01
03
05
07
09
11
13
15
17
19
21
23
25
27
29
31
Date (July 2017)
MA data are currently being validated by MassDEP, Division of Watershed Management, and are considered DRAFT.

Summary

- MassDEP buoys address data gaps in Mount Hope Bay
- D.O. is among a suite of simultaneous measurements
  - Surface and bottom D.O. measurements exhibit temporal variability
  - D.O. variability patterns are similar for MHB buoys (MA and RI)
  - Water temperature and algal blooms influence D.O. variability
- D.O. measurements exceed (fall below) MA criteria
  - D.O. data also exceed other thresholds, including RI criteria
  - Summer months can exhibit sustained periods below thresholds
- Buoy data informs both MassDEP's D.O. criteria review and the development of a regional monitoring strategy

Questions?



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